An exact transverse Helmholtz equation: erratum

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The inclusion of all higher-order terms in the refractive index variation δn, missing in J. Opt. Soc. Am. B **17**, 809 (2000), allows us to recover the correct transverse Helmholtz equation. © 2009 Optical Society of America

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After the publication of our paper, we have realized that Eq. (10) of [1] was valid only to the first significant order. In fact, the set of Eqs. (7) of [1] [Eqs. (E1) of [2]] is correct if the square of the refractive index $[n^2 = n_0^2 + 2n_0\delta n + (\delta n)^2]$ is approximately written as $n^2 = n_0^2 + 2n_0\delta n$. For the general case, in which $(\delta n)^2$ is not neglected, Eqs. (7) of [1] have to be replaced by

$$\left(i\frac{\partial}{\partial z} + \hat{L}\right)\mathbf{E}' = -\frac{k^2}{\hat{L}}(\Delta n \mathbf{E}_\perp) + \nabla_\perp\left[\Delta\tilde{n}\frac{1}{\hat{L}}\nabla_\perp \cdot (\mathbf{E}' - \mathbf{E}'')\right] - \frac{1}{\hat{L}}\nabla_\perp[\nabla_\perp \cdot (\Delta n \mathbf{E}_\perp)],$$

$$\left(i\frac{\partial}{\partial z} - \hat{L}\right)\mathbf{E}'' = \frac{k^2}{\hat{L}}(\Delta n \mathbf{E}_\perp) + \nabla_\perp\left[\Delta\tilde{n}\frac{1}{\hat{L}}\nabla_\perp \cdot (\mathbf{E}' - \mathbf{E}'')\right] + \frac{1}{\hat{L}}\nabla_\perp[\nabla_\perp \cdot (\Delta n \mathbf{E}_\perp)], \tag{1}$$

where

$$\Delta\tilde{n} = n_0\frac{\Delta n}{1 + 2\Delta n}, \tag{2}$$

with $\Delta n = (n^2 - n_0^2)/2n_0^2$.

Following now the procedure adopted in [1] and leading to a single second-order equation for $\mathbf{E}_\perp$, we obtain

$$\nabla^2\mathbf{E}_\perp + k^2(n^2/n_0^2)\mathbf{E}_\perp + \nabla_\perp[\mathbf{E}_\perp \cdot \nabla_\perp \ln(1 + 2\Delta n)] = 0, \tag{3}$$

which coincides with the equation reported in [3]. Accordingly, the set of Eqs. (1) is the correct one for describing in terms of two first-order differential equations, and to all orders in δn, propagation in an isotropic medium with refractive index n(x,y).

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